Tintinnid (Protozoa: Ciliophora) species in the Edremit Bay

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Abstract

The aim of this study is to identify the tintinnid species living in the coastal waters of the Edremit Bay of the Aegean Sea. In this study, the samples were collected from the surface and 3 stations on seasonal basis between 2003 and 2004 using a plankton net with 55 μm pore size. In the identification of species made on the basis of lorica shape, 16 tintinnid species belonging to 7 families and 10 genera were determined. Besides, this first study performed in the Edremit Bay on this subject also includes the basic hydrographic conditions of the environment such as temperature, salinity and dissolved oxygen.

Keywords: Tintinnids, Protozooplankton, Edremit Bay.
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Introduction

Tintinnids are one of the most important groups of marine planktonic ciliates and their distribution in seas and oceans displays a cosmopolitan character (Marshall 1969). Within the food chain in seas, they form an essential link between autotrophic organisms and higher-level heterotrophic ones (Middlebrook et al. 1987; Pierce and Turner 1992). In addition, they can consume up to 60% of the primary production in an ecosystem through their grazing capacities of high level (Sherr et al. 1986). The protoplasts of free swimming ciliates are protected with either transparent or particulated lorica, depending on the species. Although the shape of lorica is used as an important characteristic in the identification of species, it should be remembered that lorica demonstrates high level of polymorphism (Laval-Peuto and Brownlee 1986; Wasik and Mikolajczyk 1994).

The Edremit Bay is one of the most popular sites of the Aegean Sea in terms of tourism and fishing. Situated along the coasts of Çanakkale and Balıkesir, the Edremit Bay starts from the Babakale Cape and extends till Ayvalık. Lesbos Island is located in the southwest of the Bay and the Bay opens to the Dikili Bay through the Lesbos Canal and to the north of the Aegean Sea through the Müsellim Passage (Ceyhan et al. 2006). The fact that its bottom structure is suitable for trawl hunting and that the bay is sometimes nourished with highly-nutrient waters with Black Sea origin brought by the erosion around the region makes the area an important fishing site (Kocataş and Bilecik 1992).

Despite the fact that there is only one plankton-related study conducted in the Edremit Bay and that study does not include tintinnids (Gökalp 1972), there are extensive studies on plankton in the Aegean Sea also including tintinnid species (Ergen 1967; Koray 1987; Koray and Özel 1983; Koray and Kesici 1994; Koray et al. 1994, 2000; Çolak-Sabancı and Koray 2001; Balkıs and Wasik 2005).

The aim of this study is to identify what the previously-unsought tintinnid species of the region living in the coastal waters of the Edremit Bay are and to demonstrate their seasonal distribution.

Material and Method

This study was conducted seasonally in the coastal waters of the Edremit Bay of the Aegean Sea between 2003 and 2004. The samples were collected from the surface and 3 stations by using a plankton net with 55 μm pore size (Fig. 1) and were fixed with neutral 4% formaldehyde solution. Material was observed by using Olympus-CK2 inverted phase-contrast microscope equipped with a microphotosystem at a magnification of 400x. References used to identify the tintinnids were Trégouboff and Rose (1957), Balech (1959), Marshall (1969), Koray and Özel (1983), Chihara and Murano (1997), Alder (1999), Thompson et al. (1999), Polat et al. (2001), Balkıs (2004), Urrutxurtu (2004) and Abboud-Abi Saab (2008).

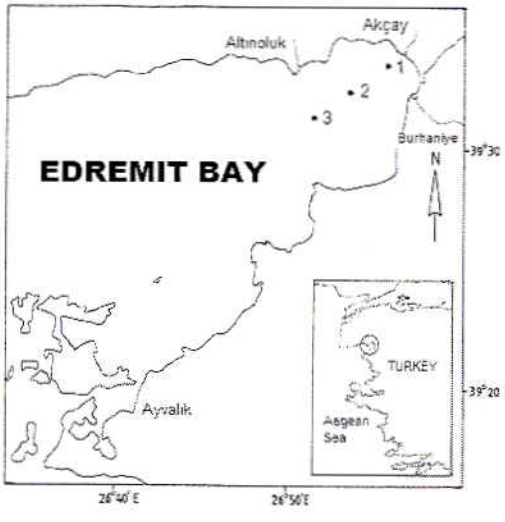

Figure 1. Sampling stations in the Edremit Bay.

Results

As a result of this study, 16 tintinnid species belonging to 7 families and 10 genera were identified (Fig. 2). Alder (1999) was used in classification of species. These species are listed below.

Classis: Oligotrichea Bütschli, 1887
Ordo: Tintinnida Kofoid and Campbell, 1929
Familia: Codonellidae Kent, 1881
Genus: ***Tintinnopsis*** Stein, 1867
Tintinnopsis campanula (Ehrenberg, 1840) Daday, 1887
Tintinnopsis cylindrica Daday, 1887
Tintinnopsis radix (Imhof, 1886) Brandt, 1907
Familia: Codonellopsidae Kofoid and Campbell, 1929
Genus: ***Codonellopsis*** Jörgensen, 1924
Codonellopsis schabi (Brandt, 1906) Kofoid and Campbell, 1929
Familia: Metacylididae Kofoid and Campbell, 1929
Genus: ***Metacylis*** Jörgensen, 1924
Metacylis jörgenseni (Cleve, 1902) Kofoid and Campbell, 1929
Familia: Ptychocylididae Kofoid and Campbell, 1929
Genus: ***Favella*** Jörgensen, 1924
Favella azorica (Cleve, 1900) Jörgensen, 1924
Favella ehrenbergii (Claparède and Laachmann, 1858) Jörgensen, 1924
F. ehrenbergii forma *coxliella* Laval-Peuto, 1981
Favella serrata (Möbius, 1887) Jörgensen, 1924
Familia: Epiplocylididae Kofoid and Campbell, 1939
Genus: ***Epiplocylis*** Jörgensen, 1924
Epiplocylis undella (Ostenfeld and Schmidt, 1901) Balech, 1962
Familia: Rhabdonellidae Kofoid and Campbell, 1929
Genus: ***Rhabdonella*** Brandt, 1906
Rhabdonella spiralis (Fol, 1881) Brandt, 1907
Familia: Tintinnidae Claus, 1876
Genus: ***Amphorides*** Strand, 1926
Amphorides amphora (Claparède and Lachmann, 1858) Strand, 1926

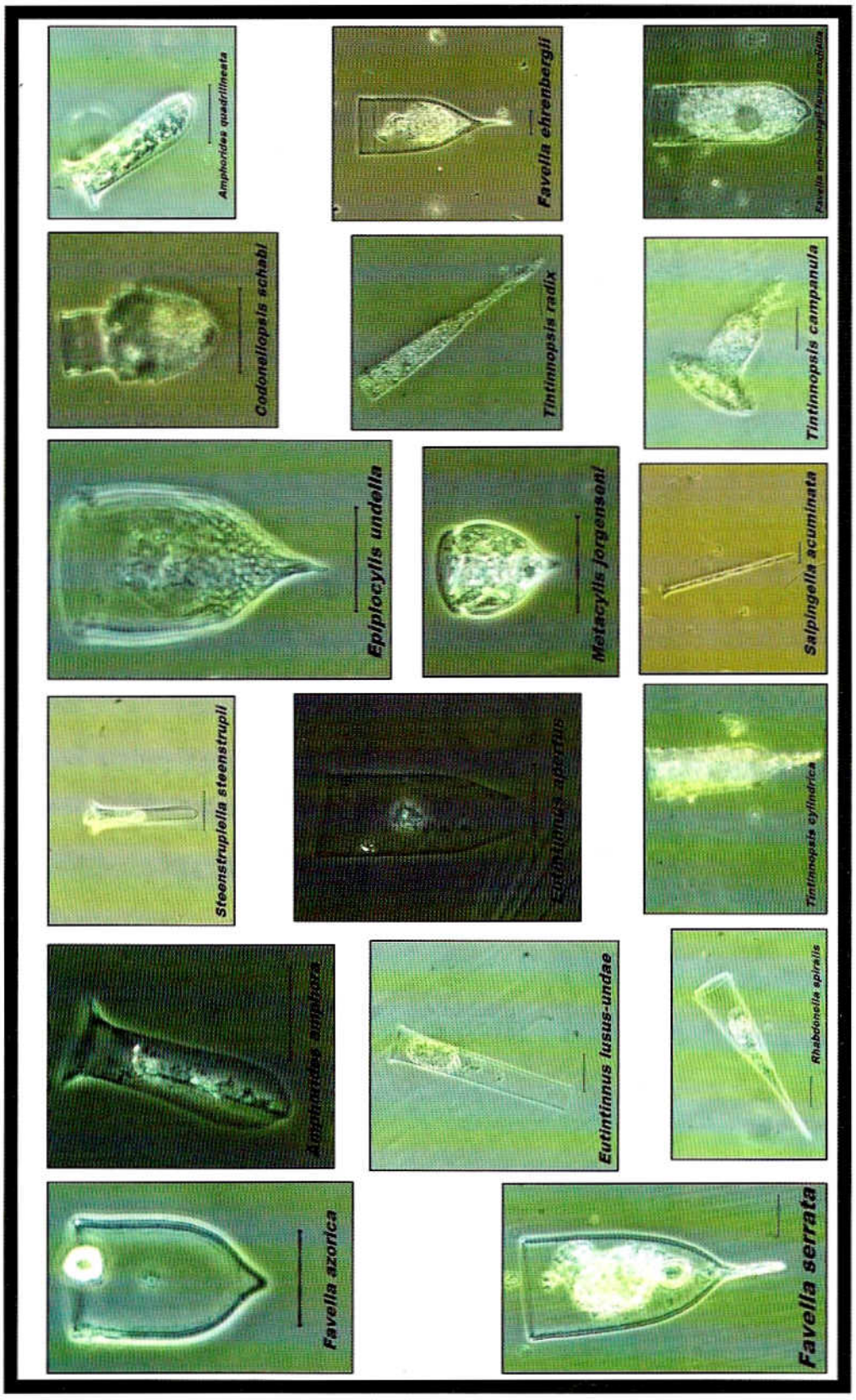

Figure 2. Tintinnid species identified in the Edremit Bay

Table 1. Distribution of the identified species as per months.

	July 2003			October 2003			January 2004			April 2004		
	Stations			Stations			Stations			Stations		
List of Species	1	2	3	1	2	3	1	2	3	1	2	3
•*Amphorides amphora*	+	+										
•*A. quadrilineata*	+		+				+	+	+			
•*Codonellopsis schabi*					+	+	+					
•*Epilocylis undella*						+						
•*Eutintinnus apertus*	+											
•*E. lusus-undae*				+	+	+			+	+	+	+
•*Favella azorica*	+											
•*F. ehrenbergii*	+		+									
F. ehrenbergii forma *coxliella*	+											
•*F. serrata*	+											
•*Metacylis joergensenii*	+	+										
•*Rhabdonella spiralis*			+	+	+			+	+			+
•*Salpingella acuminata*							+					
•*Steenstrupiella steenstrupii*					+	+	+			+		
•*Tintinnopsis campanula*				+			+	+	+			+
•*T. cylindrica*	+	+			+	+						
•*T. radix*				+								+

Amphorides quadrilineata (Claparède and Lachmann, 1858) Strand 1926

Genus: ***Eutintinnus*** Kofoid and Campbell, 1939

Eutintinnus apertus Kofoid and Campbell, 1929

Eutintinnus lusus-undae (Entz Sr., 1885) Kofoid and Campbell, 1939

Genus: ***Salpingella*** Jörgensen, 1924

Salpingella acuminata (Claparède and Lachmann, 1858) Jörgensen, 1924

Genus: ***Steenstrupiella*** Kofoid and Campbell, 1929

Steenstrupiella steenstrupii (Claparède and Lachmann,1858) Kofoid and Campbell, 1929

In terms of the number of species, *Tintinnopsis and Favella* are the genera that include the highest number of species-each include three species. The highest number of species (10 species) was seen in July 2003 while the lowest (5 species) in April 2004 (Tab. 1).

According to the biogeographic distribution of the species (Pierce and Turner 1993), *Amphorides*, *Codonellopsis*, *Epiplocylis*, *Eutintinnus*, *Salpingella* and *Steenstrupiella* are cosmopolitan, *Rhabdonella* is warm water and *Favella*, *Metacylis* and *Tintinnopsis* genus are neritic.

The surface water temperature was defined as 13-26.5 °C, while the salinity was 35.9-38.5 ppt and dissolved oxygen was 4.43-8.46 mg l^{-1}. Evident differences were not observed between the physical and chemical variables at the stations studied (Tab. 2).

Table 2. Temperature (°C), salinity (ppt) and dissolved oxygen (mg l^{-1}) values detected in the surface water of the Edremit Bay.

	July 2003			October 2003			January 2004			April 2004		
	Stations			Stations			Stations			Stations		
	1	2	3	1	2	3	1	2	3	1	2	3
Temperature	26.5	26.5	26.0	21.2	21.2	21.2	13.0	13.0	13.0	15.6	15.6	15.8
Salinity	37.5	37.8	37.8	38.5	38.3	38.2	36.9	36.9	36.8	36.8	35.9	36.1
Dissolved oxygen	8.24	6.56	6.52	5.64	5.30	4.43	8.46	4.57	6.86	4.44	5.68	5.49

Discussion

Up to date, 174 tintinnid species were identified in the Mediterranean Sea (Trégouboff and Rose 1957). Pitta et al. (2001) reported 55 species in the sampling made in east-west direction while Balech (1959) 60 species, Travers and Travers (1975) 82 species and Gómez and Gorsky (2003) 19 species in the studies in Western Mediterranean. In addition, in Eastern Mediterranean El-Maghraby and Halim (1965) identified 17 species, Kimor and Wood (1975) 10 species and Polat et al. (2001) 48 species.

In the Turkish territorial waters of the Black Sea, Öztürk (1999) reported 17 and Türkoğlu and Koray (2000) 18 tintinnid species while Balkıs (2004) identified 14 species at the Sea of Marmara. In the studies conducted in Turkish waters of the Aegean Sea, Koray and Özel (1983) reported 45 tintinnid species from the İzmir Bay; Koray et al. (1994) 25 from the Gökova Bay and Balkıs and Wasik (2005) 36 from Bozcaada. Besides, Pitta and Ginnakourou (2000) mentioned of 82 ciliate species in the Aegean Sea and reported that the southern part of the Aegean Sea is richer than the northern in terms of species. In addition, in another study performed in the Turkish territorial waters (Koray and et al. 2000), the Aegean Sea was reported to be richer in terms of tintinnid species composition when compared to the Black Sea and the Mediterranean.

Coxliella annulata and *C. decipiens* are phenotypic variations of *Favella ehrenbergii* (Laval-Peuto 1981, 1983). Therefore, *C. annulata* identified at the study area was mentioned as *F. ehrenbergii* forma *coxliella* within the list of species.

The genera *Tintinnopsis* and *Favella* are known to be widespread at coastal areas (Modigh et al. 2003). In this study, these two genera represent the groups with the highest number of species as well. The number of species is at its highest level in summer while at its lowest during spring and winter. A similar case was also observed in the Sea of Marmara (Balkıs and Wasik 2005) and the highest number of species was found during summer. In a study on this subject conducted in the Babadillimanı Bay (Polat et al. 2001) the number of tintinnids were observed to decrease in summer and increase in autumn and reach its peak value in winter. The common finding in this study is that the lowest number of species was observed in April.

In the examination of the ecology of tintinnids that can consume up to 60% of the primary production, the number of individuals is highly important. A quantitative evaluation was not performed in this study. However, the research on this subject is in progress. Besides, if the sampling had been made in more frequent periods, the number of tintinnid species identified in the Edremit Bay might have been higher as well. Seeing that pelagic ciliates and tintinnids are the main consumers of pico- and nanoplankton and that their contribution to the total primary production especially in oligotrophic waters is more than that of larger phytoplankton species, it can be concluded that there is need for studies to be carried out on the abundance of pico- and nanoplankton at the area in the future.

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